

Renewable Energy and Sustainability



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

For Grades 4 and 5

OVERVIEW

This lesson introduces students to the idea that new ways of generating energy can help our planet become environmentally healthy. Students will familiarize themselves with topics in renewable energy by engaging in an introductory class discussion, reading and discussing recommended text and the Reading Passage, and giving presentations of assigned topics. Students should have a science

notebook (a spiral notebook is suggested) to write their vocabulary words, information-organizing webs, and the various Lab Report Forms that will be used throughout future units of study.

OBJECTIVES

See Elementary School Teacher Resource Guide for TEKS objectives and additional information regarding this and other elementary school units.

SUGGESTED TIMEFRAME

Teacher will need to determine how many class periods to devote to each activity based on the suggested timeframe and length of classes.

Day	Time	Activity Title	Content Area	Activity Task
1	40 minutes total 10 minutes 30 minutes	Activity 1 – Teacher Introduction Activity 2 – Assessment of Student Knowledge	Science Assessment	Information synthesis Identify & describe learned materials
2	95 minutes total 70 minutes 25 minutes	Activity 1 – Vocabulary Activity 2 – Literature Link	Vocabulary & Language Arts Reading	Vocabulary & development application Reading for meaning
3	55 minutes total 45 minutes 10 minutes	Activity 1 – Reading and Cooperative Group Work Activity 2 – Homework assignment – Personal Reflective Writing due Day 5	Reading Language Arts	Reading for meaning Looking for vocabulary in context Use of graphic organizer Establishing a real-world connection
4	60 minutes total 60 minutes	Activity – Group Presentations	Language Arts	Application of learned knowledge in verbal & graphical format
5	80 minutes total 60 minutes 20 minutes	Activity 1 – Create Information Display Activity 2 – Assessment Collect Homework from Day 3	Language Arts Science	Information synthesis in graphical format Review of learned material

REQUIRED MATERIALS

- copy of the Reading Passage for each student
- copy of Assessment Questions for each student
- list of vocabulary words displayed so the entire class can view it (i.e. overhead transparency, chalkboard, poster, etc.)
- five large sheets of paper
- *Brother Eagle, Sister Sky* by Chief Seattle, Dial Books, 1991

DAILY ACTIVITIES

Day 1 – 40 minutes

Activity 1 – Teacher Introduction

(10 minutes)

Begin the unit with an anticipatory set that sparks the class' attention and makes the subject relevant to the students' lives. A suggested activity for this unit is to ask the class to list all their daily activities that they can think of. Then identify which activities involve energy of some sort such as electricity, gas, etc. (answers can be written in a T-chart) Next ask students to imagine life without energy and not being able to do many of the things they do on a daily basis to help realize the impact energy has on their lives. (See Teacher Resource Guide for other suggestions.) Continue the introduction by telling students that for the next unit of study they will be learning about the history of energy in Texas, how much the sun is a part of each person's life, and how we use the sun, wind and garbage to create electricity in Texas.

Activity 2 – Assessment of Current Student Knowledge (30 minutes)

To assess what students already know, prompt a class discussion based on the 7 questions listed below. A graphic organizer (such as a web) is a good tool to use during this discussion because it allows visual learners to make connections to concepts they already know. Sample graph organizers are included in the Teacher Resource Guide. The graphic organizer should be formatted so that information can be added to it throughout the unit of study.

Questions for class discussion:

1. What is the difference between renewable and non-renewable energy?
2. How does the sun contribute to and affect our lives?
3. Why have coal, oil and natural gas been used in the 20th century to produce electricity?
4. How is wind energy used in Texas to produce electricity?
5. What are some ways that we use energy?
6. What are some ways consumers can be more efficient in their energy use?
7. How does the way homes are designed help us be more energy efficient?

Day 2 – 95 minutes

Activity 1 – Vocabulary Review

(70 minutes)

Have the students use dictionaries to find the definitions of the vocabulary words and record them in their science notebooks. See list of vocabulary words on page 6. They should create meaningful sentences with each word that reflect an understanding of the definition. If you began the alternative vocabulary activity suggested in the Teacher Resource Guide, ask students to pull the cards with words relevant to this unit. Students can first quiz each other using the flash cards they prepared, or students can play the board game they created, and then create sentences in their science notebooks using each word.

Activity 2 – Literature Link (25 minutes)

Read *Brother Eagle, Sister Sky* to the class. As a class discussion, have the students summarize the story and identify the main ideas. Consider the message that each main idea portrays.

Day 3 – 55 minutes

Activity 1 – Reading and Cooperative Group Work (45 minutes)

1. On the large sheets of paper, write down a topic heading and its respective questions

allowing space for answers to be added (see “Group Reading Section Topics and Questions” on the following page). Each topic with its respective questions should appear on a separate page.

2. Organize the students into 5 equal groups, attempting to cluster reading skills. Assign each group to one of the reading topics that are based on sections from the Reading Passage. Assign the longer sections to the more advanced readers. Distribute to each group the large sheet of paper with its topic and questions written on it.
3. In the small groups, instruct the students to read aloud individual sentences or paragraphs from the assigned section of the Reading Passage.
4. Once all the paragraphs have been read, each group should create answers to the assigned questions for their section and record them on the large sheet of paper. Instruct each group to create a new graphic (chart, image, etc.) with a caption that illustrates the concepts described in their assigned section. Explain to the class that each group will make a presentation on the following day about their reading section. The presentation should present the answers to the questions and use their new graphic to illustrate the concepts. Inform the class that assessment questions will include information from each group. (See Teacher Resource Guide for reading passage assignments and group presentation guidelines.)

Group Reading Section Topics and Questions

Group 1 – The age of new energy

1. What are some of today’s new sources of energy?
2. What are some examples of fossil fuels? Do we have a lot of them? Do they create pollution?
3. What are some examples of renewable energy? Can they be used up? Do they create pollution?

Group 2 – Earth is a spaceship

1. How is the Earth like a spaceship?
2. In the past, how did people view the Earth’s spaceship?
3. How do people view the Earth’s spaceship now?

Group 3 – Sustainability

1. What does “sustainability” mean?
2. What will happen if we keep using non-renewable energy?
3. Do you think renewable energy would be better for our planet? Why or why not?

Group 4 – Global warming

1. How can the Earth and its atmosphere act like a greenhouse?
2. What causes global warming?
3. What can we do to stop or slow global warming?

Group 5 – New energy tools

1. Why do we need energy?
2. What is an example of a new energy tool being used today?
3. What are some new sources of energy?

Activity 2 – Homework Assignment

Due on Day 5 (10 minutes)

Personal Reflective Writing—Have students look at their use of energy in their everyday life at home and school and describe one type of energy used each day. For example, students can write about: gasoline used in their school bus or other vehicle that brings them to and from school each day, various appliances in their home that use energy, having a fire in their fireplace to keep them warm, etc.

Day 4 – 60 minutes

Activity – Group Presentations

(5-10 minutes)

1. Allow students 5-10 minutes to meet in their groups from Day 3 and review the material they will include in their presentation (topics from the discussion questions, new graphic created, etc.).

2. Bring students together as a class and have each group present their topic (allow 10 minutes for each group). Remind the students that everyone will be assessed on the topics from the presentations, so they should all pay close attention.
3. After all the student groups have presented their information, refer to the graphic organizer created on Day 1. With the entire class, add to the graphic organizer any new concepts that the students learned. Be sure to include any information required for answering the Assessment Questions.

Day 5 – 80 minutes

Activity 1 – Create Information Display (60 minutes)

Using information gathered for the group presentations, the class should create a display (bulletin board, banner, poster, etc.) describing and illustrating the concepts they learned in this unit of study. Each group (from Day 3 and 4) can decide what information to contribute for their respective topic. Include the new graphics each group created in the display.

Activity 2 – Assessment Questions (20 minutes)

Distribute the handout of Assessment Questions to each student. Working individually, students should write down answers to the questions in the space provided.

Activity 3 – Homework Collection

Collect students' homework assignment. Review, grade and return the assignment and Assessment Questions to students the following day or as time permits.

ADDITIONAL ACTIVITIES

1. Map Work

Using a world map, locate the various places where fossil fuels are found today. Identify areas in the world that are using the highest amount of fossil fuels.

Using the same map, identify areas where renewable energy sources are being used.

Answer the following question:

How does the area where the fossil fuels are found compare to the areas that use the highest amount of energy created by these fossil fuels?

2. Telephone Interview

Contact a representative from the State Energy Conservation Office (1-800-531-5441 or www.InfinitePower.org) and set-up a phone interview between the representative and a few students. Students should create a short list of questions to ask the representative regarding energy (renewable and non-renewable sources).

3. Guest Speaker

Arrange with your local electric utility company to have a representative talk to your class about the fuel mix used in local electricity generation and its plans for renewable energy generation.

4. Field Trip

Visit the local power plant to observe the source(s) of electricity generation in your community. Ask questions about the utility's plans for future renewable energy generation. Determine to what degree the local electric utility's energy sources are sustainable.

Group Reading Section Questions

Group 1 – The age of new energy

1. Today's new sources of energy include sunlight, wind and water: special shingles or panels that change sunshine into electricity (solar energy); huge towers with slow-turning propellers that change wind energy into electricity; free light and heat from the sun (passive solar energy).
2. Coal, oil and natural gas are examples of fossil fuels. We have only a limited supply of them. Yes, they create pollution.
3. Sunlight, wind and water are some examples of renewable energy. Renewable energy can not be used up. It does not create pollution.

Group 2 – Earth is a spaceship

1. Like a spaceship, our planet carries a limited supply of air, fresh water, coal, oil and natural gas; we have to keep all of our trash and pollution with us.
2. People believed the Earth's resources would never run out.
3. Many people have decided that we are treating the Earth's spaceship badly and that this is unfair.

Group 3 – Sustainability

1. Sustainability means that we make sure we meet our energy needs now without stopping the people in the future from meeting theirs.
2. If we keep using non-renewable energy, pollution will become a serious problem, and we will run out of the energy.
3. Requires students to draw a conclusion: yes, renewable energy would be better for the planet because it does not pollute and will not run out.

Group 4 – Global warming

1. Light from the sun hits the Earth and changes into heat, which is trapped by the blanket of air surrounding the Earth. Light can pass through the atmosphere like the glass in a greenhouse, but heat cannot escape.
2. Pollution in our atmosphere traps more of the sun's heat energy.
3. We stop or slow global warming by changing the way we use energy: use less by efficiency; use renewable sources and stop burning fossil fuels.

Group 5 – New energy tools

1. Energy helps us do things every day, like giving us light, warming our bodies and homes, cooking food, keeping food cold, running our TVs, cars and toys.
2. Compact fluorescent light bulbs are an example of new energy tools being used today.
3. Wind farms and solar panels (or wind and sunshine) are new sources of energy.

Assessment Questions

(descriptive answers may vary)

- A.1. Answers will vary: solar, wind, biomass, geothermal, hydroelectric, etc.
- A.2. The three types of fossil fuels used in Texas are coal, oil, and natural gas.
- A.3. Renewable energy is energy generated from sources that are derived from and quickly replenished by the natural movements and mechanisms of the Earth, whereas non-renewable energy sources have a limit to their supply.
- A.4. Accept students' personal entries. Possible ideas would include placement of eaves, planting of deciduous trees, window options, solar ovens incorporated into their house and rainwater collection.
- A.5. Fossil fuels are non-renewable, which means they are in limited supply. Burning fossil fuels for energy causes pollution, fossil fuels are subject to price changes, and relying on them perpetuates our dependence on imported energy.
- A.6. Carbon dioxide traps heat in our atmosphere, which leads to global warming.
- A.7. Our atmosphere is like a piece of glass allowing light to pass in, but the carbon dioxide build up will not allow heat to leave the atmosphere. This causes a gradual warming on our planet.
- A.8. Burning fossil fuel pollutes our air with chemicals like carbon dioxide, which traps heat in the atmosphere.
- A.9. Scientists suggest we reduce our consumption of energy by making products that require less energy to run. We can make our cars, machines and buildings much more efficient by using technology that already exists.
- A.10. Accept your students' ideas on this. Hopefully they have become more aware of the impact we all have on the planet and will want to care for it well by conserving and being more efficient.
- A.11. Accept students' personal entries. You might expect a more efficient car that uses less fuel or has incorporated alternative sources for powering the vehicle.

Vocabulary Words

atmosphere – the gaseous mass or envelope surrounding the Earth and retained by Earth's gravitational field

biomass – organic matter, such as plants or garbage, that can be used as an energy source

coal – a natural dark brown to black soft rock used as a fuel that was formed from fossilized plants that is burned in large power plants to create electricity

electricity – electric current used or regarded as a source of power

energy – the ability to do work

energy efficiency – using less energy to perform the same function

compact fluorescent light bulb – a light bulb that fits standard light fixtures but uses a phosphor coating to transform ultraviolet energy into visible light

fossil fuel – naturally occurring carbon or hydrocarbon fuel (e.g. coal, natural gas and oil), formed by the decomposition of pre-historic organisms

fuel – something consumed to produce energy

geothermal – heat created from inside the Earth

global warming – the warming that occurs in the atmosphere that surrounds Earth because of pollution

hydroelectric – electricity produced from moving water

natural gas – a mixture of hydrocarbon gases that occurs with petroleum deposits, principally methane, and is used as a fuel and in the manufacture of organic compounds

non-renewable – something that has a limited supply that can not be replaced nor replenished

pollution – a material that is harmful to living things

renewable energy – forms of energy that derive and quickly replenish from the natural movements and mechanisms of the environment, such as sunshine, wind, movement of the seas and the heat of the Earth

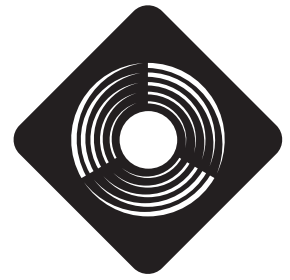
shingles – material that is laid in rows to cover the roof of a house

solar – relating to the sun

sustainable – able to supply our needs today without harming future generation's needs

thermal – using or producing heat

Renewable Energy and Sustainability



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HIGHLIGHTS

- **New energy sources are being used today**
- **Earth is a spaceship**
- **Renewable energy use is sustainable**
- **Global warming can upset the balance of life**
- **Sustainable energy is the fuel of the future—starting now**

THE AGE OF NEW ENERGY

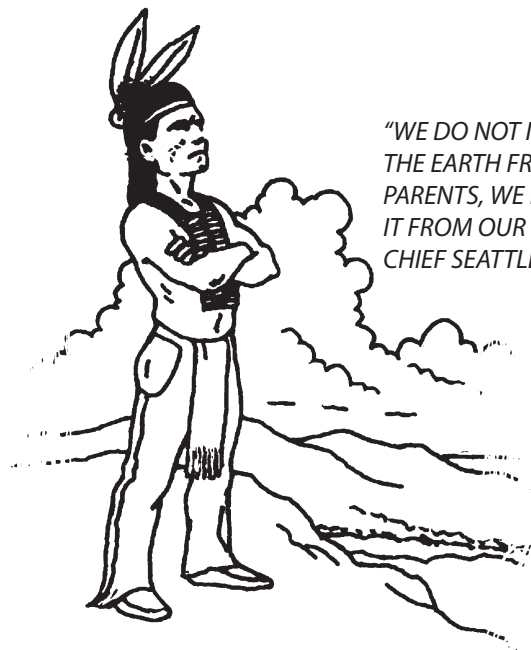
New sources of energy are being used every day. Many types of energy that we use today were not on hand 20 years ago.

Instead of getting electricity from a power plant that burns coal, your home may have a roof with special shingles or panels that change sunshine into electricity.

Out in the countryside, you may see something new in the pastures and fields. Among the cows and crops are huge towers with slow-turning propellers that change wind energy into electricity. Fields with these towers are called wind farms.

Your house may have large, south-facing windows that gather free light and heat from the sun. And your new refrigerator and other appliances may only use one-half to one-fourth the energy that they used 20 years ago.

Although today we rely mostly on fossil fuels—coal, oil and natural gas—things are changing. There is only a limited supply of fossil fuels. Once they are used up, they are gone forever. In other words, coal, oil, and natural gas are non-renewable resources. Fossil fuels also create pollution when they are burned. Pollution is harmful to plants, animals, and people.



*"WE DO NOT INHERIT
THE EARTH FROM OUR
PARENTS, WE BORROW
IT FROM OUR CHILDREN."
CHIEF SEATTLE*

New sources of energy are found in sunlight, the wind, and water. These sources are called renewable energy because they cannot be used up. They do not make pollution when they are used. This type of energy is also known as sustainable energy.

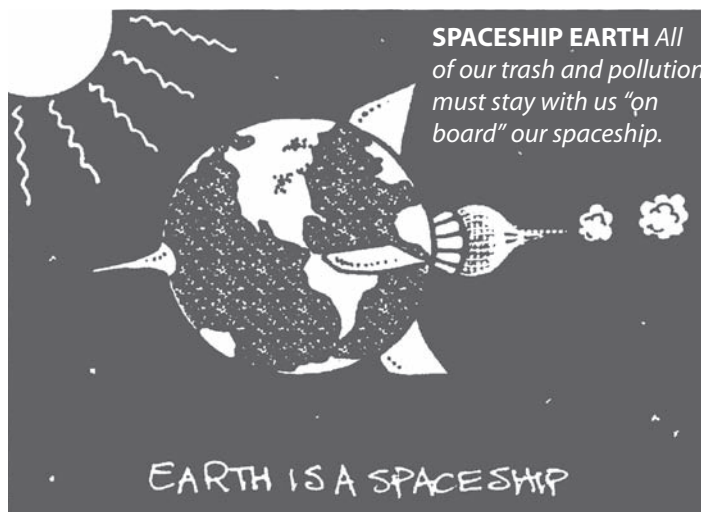
EARTH IS A SPACESHIP

As the Earth travels around the sun through space, our planet carries a limited supply of air, fresh water, coal, oil and natural gas. All of our trash and pollution must stay with us "on board" our spaceship. As more and more people live on Earth, we use more of these limited supplies. Pollution also increases.

Spaceship Earth is so huge that in the past, people believed that its resources would never run out. Some also thought that it could not be hurt by pollution. Recently, many people have decided that we are treating the Earth badly. This is not fair to the people living in the future who will inherit this planet.

SUSTAINABILITY

Non-renewable energy sources were formed millions of years ago, when dinosaurs walked the Earth. Oceans covered most of the Earth. They were filled with tiny sea plants and animals. When the plants and animals died, they sank to the bottom and were covered by sand and mud. Layers of dead plants, animals, sand and mud built up over time.



Heat and pressure turned these layers into fossil fuels such as:

- coal
- oil
- natural gas

Eventually, we will run out of non-renewable energy supplies like coal, oil and natural gas. Long before that happens, the pollution caused by using these energy sources will become a serious problem.

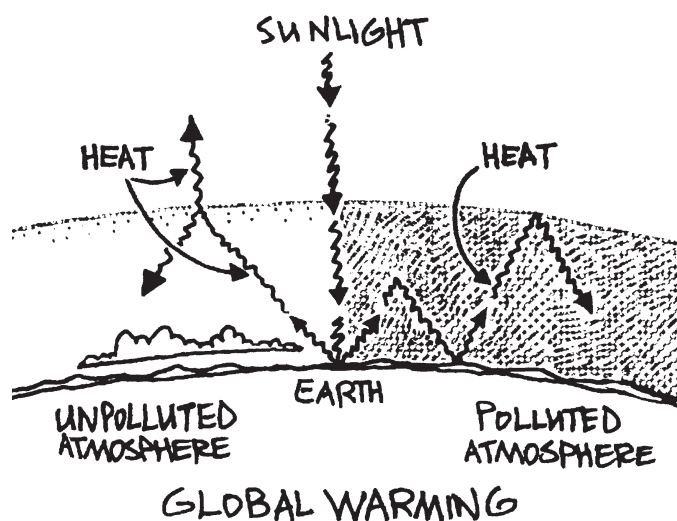
Sustainability means that we make sure we meet our energy needs now without stopping the people in the future from meeting theirs. Renewable energy sources are sources that we will not run out of. They are always being re-made by nature.

Renewable energy sources are:

- solar thermal
- wind
- hydroelectric
- energy efficiency
- solar electricity
- biomass
- geothermal

GLOBAL WARMING

A blanket of air that traps heat from the sun covers our Earth. Without this blanket, the Earth would be so cold people could



GLOBAL WARMING Pollution in our atmosphere traps more of the sun's heat energy causing global warming.

not live here. But too much trapped heat would make it too hot to live here as well.

Sometimes this blanket can act like the glass on a greenhouse when light from the sun hits the Earth and changes into heat, and the blanket traps the heat. Light can pass through the atmosphere (or glass), but heat cannot escape as easily. This causes a slow warming on our planet as heat builds up. This is called global warming. It can change the fragile balance for life on Earth.

We add to the problem by burning fossil fuels. They produce gasses like carbon dioxide (CO_2) that trap more heat and cause more global warming.

Some scientists suggest that we change the way we use energy. They say that we could cut our energy use in half just by making lights, machines, buildings and cars more efficient. In addition, half of this reduced amount could come from renewable resources such as the sun and wind.

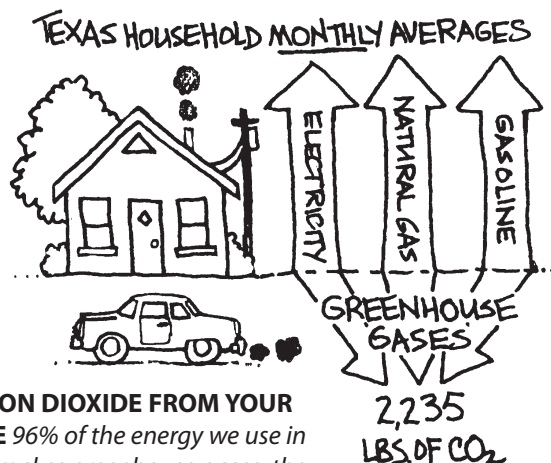
NEW ENERGY TOOLS

Energy helps us do things every day. It gives us light. It warms our bodies and homes. It helps us bake a cake and keeps our milk cold. It runs our TVs and our cars. Cars run on the energy stored in gasoline. Many toys run on the energy stored in batteries.

We are starting to change the way we use energy by using less of it. New energy tools are available today to help us do that. For example, compact fluorescent light bulbs use one-fourth the energy of a typical light bulb. Plus, they save more than \$30 over their lifetime.

We are also starting to use energy coming from different sources. Wind farms make energy for less money than burning fossil fuels. Solar panels that make electricity directly from sunshine are available now, too.

A new age of energy is starting now. Energy efficiency and clean energy from sources that will not run out may totally power your future.



CARBON DIOXIDE FROM YOUR HOME 96% of the energy we use in Texas makes greenhouse gases, the cause of global warming.

1. Recommend at least two renewable energy sources to generate electricity:

1 _____

2 _____

2. List the three types of fossil fuels used in Texas to generate electricity:

1 _____

2 _____

3 _____

3. Explain the difference between renewable and non-renewable energy resources.

4. Imagine that it is twenty years from now, and you have just bought your first energy-efficient home. Describe its energy saving features.

5. Fossil fuels are _____, which means they are in limited supply. What are some disadvantages of using fossil fuels for generating electricity?

6. How does carbon dioxide (CO₂) affect our planet?

7. Explain how our atmosphere is like a greenhouse.

8. How does burning fossil fuels affect our air quality?

9. What are some of the ways scientists recommend we reduce our energy consumption?

10. Has this unit changed your attitude about energy consumption? Give details to support your view.

11. Imagine you have bought your first car. Describe the car in detail. What makes it go? Where did you go?

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